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THE NEW PURPOSE IN STATE DEVELOPMENT: THE SAFEGUARDING ITS OWN FUTURE[1]

THE STATE GEOLOGIST AND HIS WORK IN ALABAMA

FROM time to time as I have examined one after another of the valuable series of Dr. Eugene Allen Smith's reports on the geology and resources of Alabama, I have wondered when the people of this good state would come to a full realization of the value of his work, and would show their appreciation of it in some tangible form. For he has labored faithfully and successfully in behalf of his native state. Too often it is true that geologists as well as prophets are not without honor save in their own country. I am pleased to-day to find that this is not true in Alabama; and I am more than pleased to be permitted to take part in the opening ceremonies of this splendid building, which stands as a testimonial of your appreciation of a good work well done.

And one of the best features of the occasion is the fact that this good work is still in progress. I am glad that the people of Alabama did not follow the common practise and wait until after Dr. Smith was dead, to do him and themselves honor. I rejoice with you that we are here to-day, not at a funeral service, but to do honor to and enjoy with this good man himself the recognition of not only what he has

[1]Address on the occasion of the opening of Smith Hall, housing the State Geological Survey and its collections, and the geological department of the State University, at Tuscaloosa, Ala., May 30, 1910.

done, but what he is doing, and of what he is yet to do.

Dr. Smith doubtless came into the world without his knowledge or approval; he has labored in behalf of this state and this university long and well; in due course of time he will go out of the world without his consent; for I am sure he would like to work on forever in the upbuilding of his beloved Alabama.

And if I may give to the university trustees and your state legislature one piece of good advice, it is this: During Dr. Smith's remaining years give him all the money and all the help he can use in this work. You may rest assured that with his present extensive knowledge and experience as a basis, for every dollar you now invest the state will reap a hundredfold in return.

This important work in Alabama Dr. Smith was no doubt already planning at the time of his graduation from this institution as far back as 1862, and during his subsequent studies at Heidelberg and Göttingen and Berlin. His plans were no doubt being matured when he entered the university as a member of its faculty in 1871, because shortly thereafter, in 1873, he organized the State Geological Survey on which he has served continuously to the present time

In the discharge of these double duties, his devotion to his native state has prevented his accepting more remunerative employment elsewhere, and has kept him hard and continuously at work during the past three decades. He holds the record among living state geologists for long and faithful service in behalf of a single state. And it is a record to be proud of; for among the state geologists in the United States, during the past half century, there have been many able, useful and devoted men, who have contributed largely not only to the science of geology, but to the wise development of the states they have served.

Dr. Smith's services in Alabama have witnessed, have been a part of, and have contributed to the growth of more rational plans looking to the future as well as the present welfare in the development of the state; and this phase of his work is worthy of our special attention on this occasion.

He has also stood for and has been a part of the wise state policy of connecting with its university instruction other departments of the state's activity, such as a geological survey. In this dual capacity, as university professor and state geologist, he has not only done much toward the intellectual training of the young men who safeguard the interests of the state in every phase of its life and work, but he has taught these young men to know their state; so that in their subsequent careers as legislators and teachers, and men following other vocations, they have been able to contribute toward her wiser growth, both in material and intellectual affairs. They are thus preparing not only a good foundation, but also a good superstructure, for a greater and more permanent future for Alabama.

One of the best results of this work in its bearing on the welfare of the university is the development of the recent movement inaugurated as a small beginning in 1905 for a new museum for Dr. Smith's collections; and which under the admirable leadership of Governor Comer, President Abercrombie, Mr. Hill Ferguson, president of the alumni society, Dr. Thomas M. Owen and other alumni, has developed into an important and successful movement for a greater university. The net results to-day are the two splendid buildings (Smith Hall and Comer Hall) already completed, and the academic building now under construction. Unquestion-

ably other important results will follow in the near future.

The association of his labors as state geologist with his labors as a university professor, has therefore enabled him to do to better advantage both his work for the intellectual development of the people of Alabama at the university, and the work for material development throughout the state.

NEW PURPOSE IN STATE DEVELOPMENT

Furthermore, in this double capacity Dr. Smith has contributed much to this new purpose in the state's development, namely, safeguarding the state's future welfare.

In the past, the chief idea of the state has been, and naturally so, to explore and publish its material resources, because material development has always been, and must continue to be, the important basis of intellectual growth, and even the older American states are still young. This present development of resources is the motive which has generally led to the establishment of state geological surveys; and great good has resulted along these lines. The exploration of hidden or unknown resources in different parts of the state; their advertisement to the world through the publication of geological reports has brought in new capital and population, has led to a wise use of home capital and labor, and has otherwise brought growth and prosperity to the state.

The new purpose in state development to which Dr. Smith has contributed requires that the state must not only encourage present development, but must also safeguard its own future. It is this purpose upon which the doctrine of conservation of resources is based.

This does not mean that the state should check development by endeavoring to save for the future what the citizen of to-day needs for his own use. It means that the citizen of to-day, in the use of this material, while he has a right to what he needs, has no right to *waste* or to *misuse* that which he does not need to-day, but which his children and his children's children will need hereafter. For he neither created, nor can he add to these resources, nor replace them by others when the present supply has been once exhausted. He can and should, therefore, mine, prepare and use these resources with the least possible waste, and with the greatest possible efficiency; and it is the *duty of the state* to see that this is done.

Generations come and go. The life of the individual is short; his plans and ambitions relate to temporary purposes and present profits. The state goes on forever; and *the state must safeguard its own future.* In a recent notable decision, the United States Supreme Court says: "The state as the guardian of the public welfare possesses the constitutional right to insist that its natural advantages shall remain unimpaired by its citizens."

In the developing and carrying out this purpose, it is natural and proper that the state should employ its own geologists and engineers and chemists; that it should make use of the facilities of its university; and that it should teach the new purpose to its university students as well as to its maturer citizens.

The geologist and the engineer in the employ of private capital must look primarily for present profits. The geologist and engineer in the employ of the state must give primary consideration to the permanent public welfare. And the public welfare requires that, while in the development and use of material resources present profit can not be neglected and must not be made impossible, the way must be

found of using the resources of the state with minimum waste; in order that while not preventing the profit of to-day, resources not needed for to-day may be safeguarded for the needs of to-morrow.

CONSERVATION OF RESOURCES MUST HAVE A RATIONAL BASIS

The enthusiast in preaching conservation of resources has often done harm to the doctrine by claiming that, in order to perpetuate the state's resources for future use, there should be curtailment in the use of these resources to-day. But among intelligent people, like the average citizens of the United States, any doctrine to succeed must have a rational basis. And the man who asks the question, "Why concern ourselves about the future supply of mineral resources which seem to be inexhaustible?" must be given a rational answer.

We may as well understand that the men of this generation will not mine, extract or use the state's mineral resources in such manner as to entail financial loss to themselves in order that a supply may be left for the use of the future. There will be no mineral industries without profit to those who make investments for development purposes. Men do not go into the mining business for their health! And any consideration of the doctrine of conservation of resources must be accompanied by equal consideration of the doctrine of conservation of capital, and conservation of human life.

We may as well understand also that neither the state's nor the nation's needs will be curtailed. These needs will increase with the extent and variety of our industries; and they will increase even more rapidly than our population.

Furthermore, the present generation has the power, and it has the right, to use these resources in so far as it will use them efficiently. It has the right to use as much of these resources as it actually needs. But the statesmen of to-day should remember that in any state, and in the country at large, we have but one supply of mineral resources; and when this supply is gone we shall have no other to take its place. They should remember, further, that this one supply has required millions of years for its accumulation; that the demands on this supply will increase even more rapidly than our population; and that this supply, however large, measured in the terms of the needs of a great and rapidly growing country, is a limited supply. The supply is *not* inexhaustible.

Whether we consider the resources of the state of Alabama, or the resources of the United States, there can be no doubt as to the fact that, measured in terms of the life of the state or the nation, at the present increasing rate of consumption and waste, we shall, while the state and the nation are yet in their infancy, exhaust the mineral resources necessary as the essential basis for the welfare of succeeding generations.

Having this information at hand, neither the state nor the nation can shirk the responsibility resting upon it, on the claim that succeeding generations will probably discover other now unknown resources for their use; for such conclusion would be unjust and irrational. As irrational as it would be for the farmer to use up his farm's supply of provisions during the first half of the year, trusting to luck for the other half year's supply. The right of the present generation to use efficiently of these resources whatever it needs, carries with it the sacred obligation not to waste the great heritage that has come down to us for the use of all succeeding generations of Alabama's citizens.

It is therefore reasonable to expect that

the users of the mineral resources of the state and of the nation will pay for them such prices as will make profitable their mining and preparation without serious unnecessary waste of resources or loss of life.

The very abundance and cheapness of our resources have developed an American habit of waste which is the greatest menace to our future welfare. This waste of the past and present, and the rapidly increasing needs of the present and future entail on us a still greater obligation to strive for the highest possible efficiency in the future mining and use of these resources.

This building and the work of Dr. Smith which we celebrate here to-day are definite evidence of the fact that this new purpose has already taken hold of the people of Alabama, and that they propose to support both the university and the geological survey in such future investigations of the resources of this state as will bring about not only larger development and greater present and future prosperity, but also such investigations as will, by diminishing the waste in the mining and use of these resources, aid in perpetuating their supply for the future well-being of her people.

All unscientific or *inefficient use* of *resources* is *waste;* and the most important element in the movement for rational conservation is the fact that the seemingly *necessary waste* of to-day, through inquiry or research, or through changes in economic conditions, may become the *avoidable waste* of to-morrow.

CONSERVING THE LIVES OF MINERS

Having called attention to the growth of the new purpose in the development of the state, the *perpetuation of its essential resources,* let me call attention also to another phase of this new purpose, namely, the *conserving of the lives of the miners—the men connected with mining industry.* One of the facts that stands to our national discredit in comparison with the records of other countries, is the fact that of the men employed in mining operations in the United States the percentage of those that are killed in the mines is three times as great as that in other countries. In this respect, Alabama's record is bad, but no worse than that of many other of our mining states. In the mining and quarrying operations of all the states, the record is bad—in some much worse than in others. But all along the line there is an awakening not only as to these facts, but an awakened determination to remedy the evil. There is no better illustration of this than may be seen in the admirable movement for greater safety and efficiency in mining in Alabama, led by the Tennessee Coal and Iron and Railway Company.

The investigation into the causes of mine accidents by the federal government, the enactment of better mining laws among the different states, the increasing cooperative activity of the state mine inspectors; and best of all, the increasing safety precautions by the operators, and the development of a strong, earnest spirit of cooperation between the mine owners and the miners, gives promise of a serious general effort to make mining safer in the United States, and more creditable from the humanitarian standpoint.

APPLICATION OF THESE PRINCIPLES TO COAL MINING

But if we are going to attempt seriously to reduce the loss of life and the waste of resources in coal mining, the greatest of our mining industries, we must carry on investigations and inquiries to determine the causes and to devise preventive meas-

ures; we must promptly and adequately inform the miners and active mine officials of the results of such investigations and inquiries; we must revise our laws and regulations along rational lines, in accordance with the best information thus obtained; and we must look to a proper enforcement by the states of such laws and regulations. We must also go to the tap-root of the evil —that is, we must improve the economic conditions on which this great industry is based. We must seek the needed improvements—not simply through one or two of these remedial measures, but through each and every one of them.

Our coal industry in its phenomenal growth has nearly doubled during each succeeding decade of the past eighty years. It has had to do more than keep pace with our increasing population; for, while it supplied less than one ton of coal per capita to the American people in 1870, it has had to supply nearly six tons per capita during 1907. Its growth has been too rapid for systematic development; and the industry to-day represents a great host of scattered, warring, discouraged elements, without organization or cooperation.

If the rapidly increasing rate of coal production and waste of the past eighty years should continue for another century and a half—which is possible though hardly probable—the end of the next century would see the end of the supply of coal now considered available for use. The nation must perpetuate this supply by lessening the waste, and by more efficient use.

In this industry are now employed more than 700,000 miners, who work at some 6,000 different mines, and produce annually nearly 500,000,000 tons of coal. Not only is the nation increasingly dependent upon this coal for its heat and light and for power for its varied manufacturing industries; but this coal and other mineral products now contribute about 65 per cent. of the total freight tonnage of the country; and the coal and steel are the essential factors in all our transportation facilities.

The economic conditions upon which coal mining is based in this country are so fundamentally bad, and the evil consequences are so far-reaching as to both time and extent, and are so essentially national in character, that this subject demands the earnest consideration of our best statesmen, as well as of our best engineers, whether with the federal or state governments or in the employ of private corporations.

In spite of the rapid growth in our demand for coal in Alabama and in the United States, the normal productive capacity of our coal mines, if operated continuously, would exceed this demand, and a ruinous competition exists not only between the operators in the same field, but between the operators of one field against those in another field or in another state where different mining laws and regulations are in force.

This competition is, first of all, driving out of the business the small operators, except where they find protection under local freight rates, and is forcing even the larger operator to mine coal under conditions which he can not approve, but from which he finds no escape. If he and his fellow operators endeavor to "get together" and place the price of coal at the mine on a reasonable basis, they may go to jail under either a federal or a state statute; and, as the only alternative, each must live (or succumb) by underbidding the other, which he can do only through following the wasteful and unsafe mining methods which prevail in this country to-day, in

spite of the desire of every operator to improve them.

Even when the demand for coal and the prices are at their best, under existing conditions the operator can mine only that part of his coal which can be taken out most cheaply and sold at the higher prices; and the remainder must be left underground in such shape as may preclude its future recovery. And thus we waste nearly 7,000,000 to 10,000,000 tons of coal in Alabama, and more than 250,000,000 tons of the nation's fuel supply.

But great as is this waste or loss of coal in mining, still greater is the loss in *use* of coal that is consumed in our furnaces. In the average power plant of to-day, less than ten per cent. of the energy of the coal is converted into actual work; the other 90 per cent. being used up in the furnace, the boiler, the engine and the shafting. Worse still, of the coal burned in producing the electric lights of this university—less than one per cent. of its energy is transformed into light; the other, more than 99 per cent. of the total energy being used up in the different steps of the transformation from coal into light.

The American mine owner is as humane as is the mine owner of any other country, and he would like to follow every practise and use every appliance for safety to be found in Great Britain, France, Belgium, Germany or elsewhere, but he pays his miners higher wages, and at the same time he receives for his coal at the mines half the price received for similar coal by the mine owners in those countries.

The coal industry needs and deserves fair treatment at the hands of the American people; and upon its receipt of such treatment depends in large measure not only the welfare of the operators, but also the welfare of the 700,000 miners who daily risk their lives in supplying the fuel for the nation's comfort and convenience, and the welfare of the industry itself as an essential part of our future state and national development.

In all investigations for the betterment of the mining industry, there should be hearty cooperation between the federal government dealing with the broad general problems of value to the entire country, the states dealing with problems more or less local to themselves and the private corporations dealing with still more local or individual problems. Thus we shall have greatest efficiency, and largest results, at least cost.

MINERAL RESOURCES BUILD UP AND PERPETUATE MANUFACTURES AND AGRICULTURE

I am emphasizing these conditions concerning the mining of coal, because we all recognize the fact that the coal and iron industries of the country serve as a basis of our manufacturing and other varied industries. They also serve as a basis for our transportation facilities. These in turn furnish the markets for our surplus agricultural products. For a long time in Alabama and in the United States, agriculture was, and indeed it continues to be, the chief of all the great foundation industries; but the exportation of food products from the United States is diminishing, and in a few decades more the growth of our mining population and the population connected with manufactures based on our mineral industries, will be sufficient to consume and manufacture at home the agricultural products of the continent.

But I want to call your attention to one other important phase of the mineral industries of the country as a basis of our agricultural and general prosperity. With all of Dr. Smith's enterprise and ability, he has not yet discovered within the limits

of the state of Alabama any extensive deposits of phosphates or potash mineral fertilizers. We realize that more and more every year the success of our farmers seems to depend upon their use of these fertilizers, plus the general improvement of the soil. This is because of the fact that the phosphates, the potash and the nitrogen in our soils, the three great essential mineral articles of plant food, are being gradually used up, or washed out, and new supplies must be added artificially, in order that the plant may receive a sufficient quantity of these to meet its needs.

The millions of tons of coal which are yearly produced and consumed in the state of Alabama contain large quantities of nitrogen that ought to be saved and transformed into fertilizing materials. Furthermore, through not only your coal supply, but through the great water-powers that exist in Alabama, it will be possible to take nitrogen from the atmosphere and transform it into fertilizer materials for use under your crops.

You must also not only endeavor to find supplies of phosphate and potash in the state of Alabama, but, failing in this, you must produce other products that you may export in exchange for the phosphate and potash you may need to import. Furthermore, the systems of farming must be so modified as to diminish, year by year, soil exhaustion through the leeching out and washing away of these valuable constituents.

The mining industry and agriculture will go hand in hand in their efforts to build up and perpetuate the manufactures and other varied industries of this state, and will thus safeguard the public welfare for the future no less than that of the present.

The recent progress of this university and your geological survey, and the construction and equipment of these new buildings which we celebrate to-day, are guarantees that Alabama's future as well as its present is in safe hands.

Joseph A. Holmes
Washington, D. C.

Charles Fay Wheeler[1]

It was with a sense of deep personal loss that the associates of Professor Wheeler learned of his death, March 5, at George Washington University Hospital. While those intimately associated with him were perhaps aware of his gradually failing strength, he was so cheerful in his greeting each day, so uncomplaining, that no one realized the extent or significance of his failing health.

The narrative of Professor Wheeler's early life indicates that his career as a botanist may have been the result of misfortune. Born June 14, 1842, at Mexico, Oswego County, N. Y., he spent his earliest years on the farm. In 1857 he entered Mexico Academy in his native town, but left that institution, as so many other young men left college at that time, to enter the army. He enlisted October 8, 1861, as a private in Company B, Seventh Regiment of the New York (Black Horse) Cavalry, to serve three years, but was mustered out with his company March 31, 1862. He again enlisted August 20, 1862, as a private in Company F, One Hundred and Forty-seventh Regiment of New York Infantry, to serve three years, and during the following winter was encamped with his regiment on the hill in the vicinity of the present location of Howard University. The exposure and hardships he was subjected to during this time proved too much for him to withstand, and on March 21, 1863, he was discharged by reason of disability, and in reality never fully recovered from the effects of service in the army.

Following his discharge from the federal army he was induced to go to friends at Hubbardston, Mich., where in the out-of-door life he led it was hoped he might regain his health.

[1] Read before the Botanical Society of Washington, May 28, 1910.

It was during this period of recuperation, spent almost wholly in the open air, that he became interested in the vegetation of the vicinity and began to acquire that intimate knowledge of plants that was later to ripen into an all-absorbing interest. As strength gradually returned a systematic study of the plants in his vicinity was carried on. In the autumn of 1866 Professor Wheeler entered the medical department of the University of Michigan, but after one year he returned to Hubbardston, where for the following twenty-two years he conducted a drug and book store.

During this period he was the center of the intellectual life of the village. The element of gain in connection with the business apparently entered very little into his consideration. It was a mere incident. The real purpose, the real interest of his life, was the study of his beloved plants and the lending of inspiration to others. He possessed to a remarkable degree that rare ability to create an interest in better things in all with whom he came in contact, no matter how lowly the conditions of their life might be. He formed many intimate friends among young and old, gave them an interest in science, and when they went away he corresponded with them. He sought out too people outside of his village who studied botany, and helped them. It was during this period that he laid the foundations of that rare and peculiarly intimate knowledge of plants that enabled him in his work in the Department of Agriculture later to name off-hand so much of the fragmentary material that no one else could recognize. He must also have become interested in the botany of drug material, for he certainly possessed a rare knowledge of this class of plants.

It was during the first years of his life in the drug store that he formed a lasting friendship with Dr. Erwin F. Smith, now of the Department of Agriculture, and together they planned a flora of Michigan which was published in 1881. This flora Professor Wheeler revised twelve years later in cooperation with Dr. Beal.

In 1889 his reputation as a painstaking systematic botanist was such that he was called to the Michigan Agricultural College to be instructor in the botanical department, then as now under the direction of Dr. W. J. Beal, and 1895 he was made assistant professor.

The same qualities that endeared him to the people of his village quickly made a place for him in the new life and larger field he had come to fill. One of his associates of that time says:

> No one was endowed more highly than he with that indefinable gift which arouses enthusiasm in students, and this quality, combined with a deep knowledge of his subject and a sympathetic, lovable nature, will cause him to be remembered and his memory loved by every student with whom he came in contact.

Professor Wheeler became a moving spirit in the intellectual life of the college community. There existed among the faculty at that time a literary circle, and whether the study of one of the modern languages, the reading of Molière or Shakespeare, was the object of their attention, Professor Wheeler was always the life of the gathering. He was extremely modest and shrank from participation in anything of a public nature, but among those whom he knew intimately he was at ease, and at these social gatherings of the college faculty it was indeed a pleasure to hear him read Shakespeare, for which he had a special fondness.

During the first years of this college life he was associated with Gilbert H. Hicks, whose death a few years ago was so keenly felt by many department workers. These two men working with Dr. Beal were responsible for the development of the botanical garden and the herbarium of over 100,000 specimens. The latter was formed entirely after Professor Wheeler's connection with the college, the old one having been destroyed by fire. Both the garden and herbarium are among the best, if not actually the best, of any similar institution in America. While at the college Professor Wheeler was occupied a part of the time with regular college studies and was graduated with the class of 1891, receiving the degree of bachelor of science. In 1907 his

alma mater on the occasion of the semi-centennial celebration of the college honored him with the degree of doctor of science. This was bestowed in the presence of the President of the United States, the representatives of many American and foreign institutions of learning, and before an audience of perhaps 20,000 people. To his students, however, he will always be known as "Professor Wheeler."

Well known to many in the Department of Agriculture, he was induced in 1902 to come to the department, where he entered upon systematic work in the Bureau of Plant Industry, and continued in this work until about two weeks previous to his death. His intimate associates during this time were frequently impressed with the wide experience and knowledge that Professor Wheeler possessed—an experience and knowledge acquired only through years of study of the same plants, both in the herbarium and in their natural haunts, and a knowledge not always possessed by the herbarium botanist. Professor Wheeler was not a mere collector, but a real student in the field, and so he was able to do a work in the department that perhaps no one else could do.

He was elected a member of this society in November, 1902, very soon after his coming to Washington, and was its president for the year 1907–08. His address as retiring president of the society was entitled "Thirty-six Years with Michigan Plants."

Professor Wheeler belonged to what we often term "the old school," the type of scientist represented by such men as Chester Dewey, William Oakes, John Torrey and many others that might be mentioned. He knew plants intimately and loved them. He knew something of other sciences and the relationship of systematic botany to them. His was a broad outlook upon nature. Some time when the present fascination for the newer fields of botanical research broadens out to a full appreciation of the value and relationship of all lines of botanical investigation, the training and knowledge of the old-time systematist will be appreciated as they have not been for many years.

We are inclined, perhaps unconsciously, to measure the worth of men and the extent of their influence by what they publish. Professor Wheeler published little. His real influence among his fellows is not to be estimated in printed pages, but in the unmeasurable inspiration he gave throughout his life to his students and intimate associates everywhere.

One of these friends, drawn to him through a mutual love of plants, has written of him as follows:

March 28, 1910.

Mr. C. H. Kauffman,
Vice President of Botany Section,
Michigan Academy of Science.

Dear Sir: Your letter of March 10, which reaches me on my return from a long absence, is the first notification I have had of the death of Charles Fay Wheeler. This is a particular sorrow to me, for I had known Dr. Wheeler intimately and he was one of my very first botanical acquaintances. It was more than thirty years ago that, as a student, I visited him at Hubbardston, Michigan. We had had some kindred correspondence, and his letters were so genial, so full of the love of plants, and so critical as to specific differences that I became possessed of a great desire to see him. I found him in his drug store; but plants and the fields were clearly his first love, and he took me to his collection and to some of his favorite collecting grounds. The carefulness and accuracy of his observation impressed me very much. He seemed to have an eye for critical things and for those that escaped common observation. He was at that time very keen on *Carex* and *Salix* and the grasses. He was always finding forms that did not fit the descriptions in the books; and if any plant was rare he was sure to find it if it grew within his range.

In these years he was isolated from kindred spirits, and he was hungry for botanical acquaintanceship; yet he was so exceedingly modest of his own merits that he hardly dared to seek such comradeship. I have never known a more modest and unassuming man. In later years, of course, he overcame his shyness to a great extent, but he always was content to be the listener and the student. It was a great thing for him and for botany when he was asked to come to the agricultural college and to aid in the botanical work. From that time his work took on a larger aspect, and he became one of the most critical and re-

liable systematic botanists wherever his studies led him. In the days of my botanical work it was always a great delight and support to have his judgment on different plants; and I am sure that this feeling has been shared by many others.

Dr. Wheeler was a steadfast friend. It was a great joy to go afield with him. His keen eyes saw everything, and he enjoyed nature to the full. I shall never have another such a friend. He was a rare clear spirit.

Yours truly,

L. H. BAILEY

The thoughts so well expressed in this letter by Professor Bailey are shared by his many friends in Washington, at the college, in his early village home and elsewhere. Though he lived a quiet, peaceful life his real worth will not be forgotten until those who knew him shall pass as he has done, quietly into the great beyond.

He lies buried in the National Cemetery at Arlington, within sight of the hills on the farther side of the river, where in a soldier's camp he contracted the illness that was perhaps the determining cause of his botanical career.

W. F. WIGHT

AMERICAN MATHEMATICAL PUBLICATIONS

THAT American mathematical activity has been rapidly increasing during the last few decades is a patent fact which has been the subject of considerable comment on the part of European mathematicians. It is, however, difficult to measure this activity accurately and to exhibit its increments in a clear manner. The objects of the present note are to call attention to this interesting problem and to present a few facts which seem to throw some light on it.

One of the most valuable aids for the study of current mathematical literature is the well-known *Jahrbuch über die Fortschritte der Mathematik*. The latest volume of this work lists and comments on about thirty-four hundred articles and books, which appeared during the year 1907. About one twentieth of these were by American authors who belong to the American Mathematical Society. If we compare this with the year 1892 we find that less than one fiftieth of the total mathematical output was then due to members of the corresponding society. While the total number of papers and books listed increased only about one third during this period of fifteen years those by American authors increased threefold.

This rapid advance is naturally the source of considerable optimism, but further comparisons tend to call attention to the fact that we are still far behind several other countries as regards mathematical work. For instance, although the French Mathematical Society has only half as many members as the American, yet their articles and books listed during 1907 exceed ours by a considerable number; and the German Mathematical Society, with a membership about equal to that of the American when foreign members are excluded, had twice as many publications recorded in this latest volume.

A comparison whose results appear at first as still less complimentary to our mathematical situation relates to the publications of the presidents of some of the leading mathematical societies. The societies selected were as follows: The American Mathematical Society, the London Mathematical Society, La Société Mathématique de France and Die Deutsche Mathematiker-Vereinigung. We took all the presidents of these societies for a period of sixteen years, beginning with 1894 when the American Mathematical Society assumed its present name, and looked up the number of references to their publications during the fifteen years covered by the three general indexes of the *Revue semestrielle des publications mathématiques*. The results were as follows: The average number for each of the nine American presidents is 21, for each of the eight English presidents it is 44, for each of the twelve German presidents it is 63, and for each of the sixteen French presidents it is 88.

In round numbers it thus appears that the presidents of the London Mathematical Society, during the period under consideration, published about twice as often as the presidents of the American Mathematical Society, while in the cases of the German and French

presidents this ratio becomes approximately three and four, respectively. The large average of the French presidents is due to the names Poincaré, Picard, Borel, Hadamard and D'Ocagne.

It would have been of interest to include the Italians in these comparisons, as they have recently become one of the most active nations as regards mathematical work. It is, however, somewhat doubtful whether any one Italian society represents as completely the national mathematical activity during the period under consideration as those which were selected above. The Circolo Matematico di Palermo would, however, have been placed in the list if the writer had had a complete roll of its presidents for the given period.

A noticeable feature as regards American mathematical publications is that they are to a very large extent confined to journals devoted exclusively to mathematics. Our mathematicians do not assume as prominent a place in the proceedings of our academies as European mathematicians do in the corresponding proceedings. There is a danger of too much isolation on the part of our mathematicians. It is true that this has not been without its advantages. The journals confined to mathematics generally have editors who are better judges as regards the importance of a particular mathematical article than the editors of the more general publications, and hence it has been possible to raise the standard of our mathematical products more rapidly than would have been feasible otherwise.

The question, however, remains whether it would not be better to give more freedom to authors as regards publication and to let such critical reviews as those of the *Fortschritte der Mathematik* make it clear to the young writer that it does not pay to publish while one is in ignorance as regards novelty or importance. The author's position should be dignified by every possible latitude that is consistent with efficiency and his feeling of responsibility should extend far beyond editorial surveillance.

G. A. Miller

HOME ECONOMICS

The American Home Economics Association held a sectional conference on household and institution management June 28–July 2, 1910, at the Lake Placid Club, Lake Placid, N. Y., meeting there by invitation. The attendance was large and many valuable papers were presented which had to do with institution food problems and dietary standards and with the training of dietitians and other experts, as well as with institution architecture and institution accounting. The need for standardization in various departments of institution work was one of the subjects which came up for discussion.

As a whole the meeting was of great interest, as it showed the progress which has been made in applying to problems of home and institution management the scientific and technical data accumulated in the past few years, particularly in the group of sciences included under the subject of home economics.

The Graduate School of Home Economics is to be held at Ames, Iowa, July 6–20, 1910, at a period which falls within the time covered by the Graduate School of Agriculture at the same place. The two schools will hold a number of public meetings in common and arrangements will be made for students to take advantage of both courses of lectures. Many prominent educators will take part in the work.

The Graduate School of Home Economics is the outgrowth of the Summer School of Chemistry and Biology of Middletown, Conn., which was held in the month of July, 1902, through the influence of the late Professor W. O. Atwater. Subsequent meetings were held at the University of Illinois and at Cornell University.

The Graduate School of Home Economics is closely affiliated with the American Home Economics Association.

MATHEMATICS FOR ADMISSION TO COLLEGE

A conference of representatives of the departments of mathematics of fifteen of the New England colleges and universities was

held at Cambridge, Mass., May 28, 1910. The object in the calling of the conference was to procure such action as should lead to uniformity of definition in the various divisions of mathematics which are required for admission to college. The conference organized by appointing Professor Osgood, of Harvard, chairman, and Dean Ferry, of Williams, secretary. After much discussion, it was voted to recommend to the colleges that they omit from their definitions of elementary algebra any topics which are not included in the College Entrance Examination Board's definition of that subject, and that they state their requirements in elementary algebra in such a manner as to show which, if any, of the topics in the College Entrance Examination Board's definitions are omitted or are not emphasized by them. It was voted further that the conference recommend to the colleges the adoption of the College Entrance Examination Board's definitions of the requirements in plane geometry, solid geometry, plane and solid geometry, trigonometry, plane trigonometry and advanced algebra, and that the members of the conference endeavor to persuade the faculties which they respectively represent to adopt these definitions. It was voted also that the conference recommend to the College Entrance Examination Board that no reduction in the time allowed to the individual subjects of mathematics in the examination schedule be made; but that mathematics a and mathematics cd continue to have three hours and that all other divisions of mathematics continue to have two hours each in the time schedule of the board's examinations. The faculties of many of the colleges concerned have already adopted the definitions of the College Entrance Examination Board in all admission subjects.

SCIENTIFIC NOTES AND NEWS

SIR WILLIAM RAMSAY has been elected a foreign associate of the Paris Academy of Sciences to fill the vacancy caused by the death of Alexander Agassiz.

THE Albert medal of the Royal Society of Arts for the current year has been awarded to Madame Curie for the discovery of radium.

DR. C. HART MERRIAM has resigned as chief of the Biological Survey of the U. S. Department of Agriculture and is succeeded by Mr. H. W. Henshaw. Dr. Merriam, who will retain an official connection with the survey as consulting biologist, will devote himself to the preparation of a work on the mammals of North America, under an endowment provided by Mrs. E. H. Harriman.

DR. WILLIAM T. COUNCILMAN, professor of pathology in the Harvard Medical School, gave the annual address at the commencement exercises of the Yale medical school.

PROFESSOR O. FUHRMANN, of the University of Neuchâtel, has left for a two-years' scientific expedition to explore the Cordilleras basin of the Andes.

MR. ROBERT NEWSTEAD, lecturer in economic entomology and parasitology at the Liverpool School of Tropical Medicine, has gone to Malta to investigate the menace to health by the sand-fly.

DR. F. P. MALL, professor of anatomy in the Johns Hopkins University, is at present in Germany.

MISS M. A. WILLCOX has resigned the professorship of zoology at Wellesley College, receiving the title of professor emeritus. Her future address will be Malden, Mass.

THE prize of £50 from the Gordon Wigan fund, Cambridge University, for a research in chemistry has been awarded to Mr. J. Thomas, Trinity, for experimental investigations on "The isolation of the aromatic sulphinic acids" and "The resolution of externally compensated quinoline derivatives containing two asymmetric carbon atoms."

THE British birthday honors in so far as they concern men of science are summarized in *Nature* as follows: Among the new privy councillors is the name of Sir William Mather, who has done much to promote technical education. The honor of knighthood has been conferred upon Mr. H. Hall, inspector of mines for the Liverpool and North Wales district, and Dr. A. Hopkinson, vice-chancellor and principal of the Victoria University of Manchester. Colonel F. B. Longe,

surveyor-general of India, and Dr. R. T. Glazebrook, F.R.S., become Companions of the Bath (C.B.). Mr. J. H. Marshall, director-general of archeology in India, Mr. C. Michie Smith, director of the Kodaikanal and Madras Observatories, and Dr. M. Aurel Stein, superintendent of the Archeological Survey, are appointed Commanders of the Indian Empire (C.I.E.). The order of C.M.G. has been conferred on Dr. A. D. P. Hodges, principal medical officer of the Uganda Protectorate, in recognition of his services in the suppression of sleeping sickness, and on Professor T. W. Edgeworth David, F.R.S., of the University of Sydney. Mr. C. O. Waterhouse, of the British Museum (Natural History), has been appointed a Companion of the Imperial Service Order.

English journals state that a memorial to Lieutenant Boyd Alexander, who was murdered in the French Sudan in April, and his brother, Captain Claud Alexander, formerly of the Scots Guards, who also lost his life in Central Africa while engaged in scientific exploration, has just been completed at Wilsley House, Cranbrook, the residence of Colonel Alexander, their father. A sheet of water on the estate has been laid out as an exact reproduction in miniature of Lake Chad from plans by Lieutenant Boyd Alexander. On the islands and banks of the lake are reproductions of thatched native huts, and there is preserved on the adjacent lawn one of the boats in which the Alexander-Gosling Expedition made its way down the river Yo to the Nile.

Mr. C. Greville Williams, F.R.S., known for his contributions to organic chemistry, and formerly connected with the University of Edinburgh, has died at the age of eighty-one years.

Mr. S. A. Stewart, until recently curator of the Belfast Natural History and Philosophical Society, known for his contributions to botany and geology, died on June 15, at the age of eighty-four years.

Dr. Emil Zucker Kandl, professor of anatomy at Vienna, died on May 28, at the age of eighty-six years.

Among positions to be filled by New York state civil service examinations on July 23, are those of statistician at salaries from $1,200 to $2,400, and of supervisor of agricultural education at a salary of $2,500.

The Boston University School of Medicine, a homeopathic institution, has received a gift of $200,000 from Mrs. Robert Dawson Evans, of Boston, for an Institute of Clinical Research and Preventive Medicine in memory of her late husband.

Mrs. Russell Sage has given $15,000 to the National Association of Audubon Societies, to be expended for bird protection, especially in the southern states.

For several reasons it has been decided to hold no summer meeting of Section E of the American Association for the Advancement of Science early in July. (1) These summer meetings have been attended so largely by educators in the eastern states that it seemed unwise to hold a summer meeting at the time of the meeting of the National Education Association, the week beginning July 4. (2) Mr. R. W. Brock, director of the Canadian Survey has decided that it will be impossible to hold a meeting in Canada this summer as was suggested at the Boston meeting. (3) Many geologists will attend the International Geological Congress in August and September. Those who might be able to attend a meeting the latter part of August or the first of September are requested to communicate with the secretary of the section, Dr. F. P. Gulliver, 30 Huntington Lane, Norwich, Conn.

The secretary of the eastern branch of the American Society of Zoologists has received communications from Dr. Weber, general secretary for the scientific department of the International Hygiene Exhibition, to be held at Dresden in 1911, inviting members to send exhibits to the scientific section and also urging them to visit the exhibition. A limited number of blank forms of application for space and some printed information relating to the exhibition is in the hands of the secretary of the Eastern Branch of the Zoologists, Herbert W. Rand, Harvard University.

THE London *Times* states that Captain Scott's Antarctic ship *Terra Nova* left Madeira on June 26 for Simonstown, where she is due to arrive on August 1. Captain Scott, accompanied by Mrs. Scott and Mr. Drake, will sail from Southampton in the *Saxon* on July 16, arriving at Cape Town the day after the arrival in South Africa of the *Terra Nova*. The vessel will sail from Cape Town on August 9 for Melbourne, which port, after a stay of a week, she will leave on September 20 for Sydney. There she will remain for ten days, being due to reach Lyttelton on October 14. On November 15 she will set sail for the Antarctic, and it is expected that she will reach the base on King Edward VII. Land on December 15. Captain Scott will make a stay of about ten days in South Africa, having arranged to sail from Cape Town in the steamship *Athenic* on August 13. Of other members of the expedition who are still in this country Lieutenant Bruce leaves next week for Vladivostok, where he will join Mr. Meares, who has been collecting dogs and ponies. Both will reach Kobe on August 6 *en route* for New Zealand. Mr. H. G. Ponting, the photographer, will sail from London in the India on August 12, reaching Sydney on September 22. Mr. Day, with the motor sledges, will leave England on August 4. Mr. Borup, who was with Commander Peary, has given Captain Scott three Eskimo dogs; and Mr. G. F. Wyatt, of the expedition, will leave on July 27 for New York, where he will pick up the dogs and go to New Zealand *via* Vancouver.

THE expedition sent by the committee of the British Ornithologists' Union to explore the snow mountains in Dutch New Guinea has reached the field of its inquiries, and a correspondent of the London *Times* says that news has been received that it has made a discovery which should prove of interest to anthropologists. At an elevation of about 2,000 feet they have come across a tribe of pygmy people, the average height of whom is about 4 feet, 3 inches, and though at present no definite details have been received, there can be little doubt that they belong to that division of the human race known as the Négritos. The present discovery will account, it is said, for the presence of various anomalous races in the remoter parts of the Lesser Sunda Islands.

AT Butte, Mont., and the Coeur d'Alenes this summer groups of students from the mining engineering class of the University of Wisconsin who will enter the senior year next fall are learning by personal experience what constitutes a day's work in the mines, and what are the habits and viewpoints of the men with whom, as mining engineers, they will have to deal in the future. The work of the summer school in mining for students of engineering covers six weeks, and is required previous to their senior studies. A new arrangement whereby separate squads go out to the mining camps in various districts of the country for field work, is providing a much more effective method of preparing students for the advanced work of the senior year than the system previously in vogue, which included much class work at the university. Professor E. C. Holden, in charge of the mining engineering work at Wisconsin, is spending the summer going from one mining camp to another supervising the work of the students, who will have four weeks of regular underground work, and two weeks of inspection, sketching and taking field work.

THE *Auk* gives some details in regard to the New York plumage bill, passed by the legislature of that state at its last session and signed by Governor Hughes. Some of the special provisions enacted are: "No part of the plumage, skin or body of any bird protected by this section [Sec. 98], or of any birds coming from without the state, whether belonging to the same or a different species from that native to the state of New York, provided such birds belong to the same family as those protected by this chapter, shall be sold or had in possession for sale. . . . Plumage includes any part of the feathers, head, wings or tail of any bird, and wherever the word occurs in this chapter reference is had equally to plumage of birds coming from without the state, but it shall not be construed to apply

to the feathers of birds of paradise, ostriches, domestic fowl or domestic pigeons. This act shall take effect July 1, 1911." By this act, therefore, aigrettes can not be legally sold in the state of New York after it becomes operative. The act protects not only egrets and other plume-bearing herons, but gulls, terns, albatrosses, eagles, vultures, and other birds slaughtered for their wings or quills, as well as all song and insectivorous birds.

The *Auk* states that the new edition of the American Ornithologists' Union Check-List of North American Birds, which has been some four years in preparation, will probably be ready for distribution about the end of the month. It will differ in several respects from the previous editions, both typographically and in the character of the matter. The arrangement and numeration, however, will be the same. The changes in nomenclature have already been announced in the various supplements that have been issued since the publication of the second edition in 1895, so that in this respect there will be few surprises. The "ranges," or the matter relating to the geographical distribution of the species and subspecies, have, however, been entirely rewritten and greatly amplified, thus fully reflecting the latest knowledge of the subject. Besides being given in greater detail and with more definiteness, they are arranged to show not only the general range of the forms, but also the breeding and winter ranges, so far as these are at present known. An abbreviated edition of the Check-List, consisting only of the English and technical names, numbered in accordance with the numeration of the previous editions of the Check-List, is in preparation and will be issued at about the same time as the regular edition. It will be of small size, with rounded corners and flexible covers, and thus handy for the pocket, and be printed on only one side of the leaf, thereby providing convenient space for annotations.

Coal-mine fatalities in the United States in 1909 were fewer than in 1908, notwithstanding an increase of approximately 10 per cent. in the quantity of coal mined. The figures compiled by Edward W. Parker, statistician in charge, division of mineral resources, U. S. Geological Survey, show the total number of deaths from coal-mine accidents in 1909 to have been 2,412, against 2,450 in the preceding year. During the last five years the annual reports of the Geological Survey on the production of coal have contained a chapter on coal-mining accidents, their causes, and the relations to the number of men employed and the tonnage produced. These statistics are compiled almost entirely from statements furnished by state mine inspectors. It is expected that statistics of mine accidents in future years will be compiled by the new Bureau of Mines. The decrease in the number of fatal accidents during 1909 is the more gratifying from the fact that in the statistics for last year are represented four states—Georgia, Oregon, Texas and Virginia—from which no reports of accidents had previously been received. The statistics for these states were compiled from reports received by the Geological Survey from the operators. From the statistics of production in some of the more important states, as reported by the state officials, it is estimated that the total output in 1909 was approximately 450,000,000 short tons, against 416,000,000 tons in 1908. According to this estimate the production of coal in 1909 was 186,567 short tons for each life lost, against 167,545 tons in 1908. In 1907, when 3,125 men were killed, 145,471 tons were mined for each life lost. This was the year in which was made the darkest record in the history of the industry.

UNIVERSITY AND EDUCATIONAL NEWS

Dr. F. C. Shattuck, Jackson professor of clinical medicine in the Harvard Medical School, has offered to endow with $25,000 a fellowship to be known as the Henry P. Walcott fellowship in clinical medicine.

By the bequest of Dr. Byron Robinson, a graduate of the University of Wisconsin in the class of '78, who died last March, the university receives a large collection of books and pamphlets on anatomy, supplementing the gift of over a thousand volumes on the history of medicine made by Dr. Robinson shortly before

his death. The collection is to be known as the Robinson-Waite Library, in honor of the donor and his wife, Dr. Lucy Waite. The whole collection amounts to over 1,500 volumes and is valued at over $4,000. Dr. Robinson's library is unusually rich in early American medical treatises and old anatomical plates, including many fine copperplates. Funds for the establishment of a scholarship in anatomy in the university medical school, valued at $550 a year, are also provided in the bequest. This will be known as the Byron Robinson scholarship in anatomy, and is to be held by men or women students in medicine. The purpose of this scholarship is to encourage the anatomical, physiological and pathological study of the sympathetic nervous system.

TEN university fellowships with a value of $300 each have been established by the board of the regents of the University of Michigan. Each fellow is liable to render service to the university to the extent of not over four hours per week and must pay all fees.

THE Catholic University of America, Washington, D. C., will recover $350,000 from the bankrupt estate of the late Thomas E. Waggaman, its former treasurer, who owed the institution $900,000 when he was adjudged bankrupt in 1904.

THE quarter centennial anniversary of the Oregon Agricultural College was celebrated on June 13 in connection with the regular commencement exercises. Mr. W. F. Herrin, of the class of '73, vice-president of the Southern Pacific Railroad Company delivered the oration.

AT the May meeting of the board of regents of the University of Michigan the following changes were made in the staff of the museum: The title of the curator, Dr. Alexander G. Ruthven, was changed to instructor in zoology and head curator of the museum, Mr. Bryant Walker was appointed honorary curator of Mollusca, and Dr. W. W. Newcomb was appointed honorary curator of Lepidoptera.

MR. WM. E. LAWRENCE has resigned an assistantship in botany at the Oklahoma Agricultural and Mechanical College to accept the instructorship in botany at the Oregon Agricultural College, Corvallis, Ore.

THE following changes occur this year in the faculty of the Oregon Agricultural College: Professor E. F. Pernot, professor of bacteriology, has resigned to enter commercial work; J. C. Bridwell, instructor in zoology and entomology, has resigned to accept a similar position in the University of California; G. W. Peavy is appointed professor of forestry to succeed E. R. Lake, who takes leave of absence; E. F. Ressler, formerly president of the Monmouth State Normal School, is appointed professor of industrial pedagogy and director of the summer school; J. F. Morel, instructor in veterinary science; W. E. Lawrence, of Oklahoma Agricultural College, instructor in botany.

THE council of Liverpool University has appointed Mr. E. C. C. Baly, F.R.S., to the Grant chair of inorganic chemistry, vacant through the death of Professor Campbell Brown. Since 1903 Mr. Baly has held the post of lecturer in spectroscopy at University College, London.

MR. F. H. HUMMEL, lecturer on civil engineering at Birmingham, has been appointed professor of engineering at Belfast.

DR. JOHANNES HARTMANN, professor of astronomy at Göttingen, has been called to Vienna.

DISCUSSION AND CORRESPONDENCE

THE APPARENT SINKING OF ICE IN LAKES

TO THE EDITOR OF SCIENCE: I have read with interest Professor Barnes's letter, in your issue of June 3, on the apparent sinking of ice in lakes. I agree completely with his explanation of the supposed "sinking" of the ice; but his theories of the precedent warming of the water are quite different from the phenomena as observed here for a good many years. Professor Barnes supposes that the water of the lake during the winter gradually rises to 4°, beginning at the bottom; when the temperature of 4° reaches the under side of the ice, melting takes place both from above and below. Hence the rapid disinte-

gration and the supposed sinking of the ice.

In Lake Mendota the mean temperature of the water immediately after the disappearance of the ice is about 2.7°, as the result of the average of seven years. It has never been above 3.5° at that time. It rarely happens that the bottom water and mud at 22 m. (the deepest water) reaches 4° before the ice disappears.

The water derived from melting snow and ice remains just below the ice, floating on the water of the lake. It becomes warmed by the sun's rays and often rises considerably above 4°. It is lighter than the lake water, having less dissolved matter, and the increase of density as the temperature rises from 0° to 4° is not sufficient to carry it down into the lake water. Immediately below the ice there is a very steep temperature gradient to the maximum and a somewhat slower decline below. The maximum usually comes about 0.5 m. below the under side of the ice. I give a series taken April 3, 1901, when the ice was about 30 cm. thick. The distances are measured from the surface of the water.

Depth	Temperature
In hole through ice	0.2°
40 cm.	3.8°
50 "	4.5°
60 "	5.5°
75 "	5.9°
100 "	5.5°
125 "	4.0°
150 "	2.5°
2 m.	2.3°
10 "	2.2°
15 "	2.4°
18.5 m.	2.8° bottom.

The ice went out April 11; on that day the temperature at 2 m. and below had not changed materially. Facts similar to these appear every year.

If a lake contains little or no dissolved matter the snow water would mingle more freely with it than in a lake like Mendota, and the rise of temperature in the surface stratum might not be so marked; although it would hardly be absent altogether. But if no surface rise occurred, I see no reason why the thawing of the ice should wait until the water below the ice has reached the temperature of 4°. From 60 per cent. to 80 per cent. of the sun's energy is delivered directly to the ice in any case, and is employed in melting it, and dissecting it into crystals. As soon as this process has gone far enough to loosen the crystals from each other they will fall apart, regardless of the temperature of the underlying water. It is always possible that the ice will disappear in this way, "all at once and nothing first"; but I have never known it to do so; in Lake Mendota a wind has been the agent which has shattered the last hold of the crystals on each other and converted the sheet of ice into a mush of crystals rapidly melting in the warmer water.

Professor Barnes thinks that much of the later part of the melting of the ice comes from the warm water below it. I have never seen evidence that such is the case. Unless the water below the ice is warmer than 4° there would be a non-conducting layer of colder water constantly between the ice and the warmer water. If the temperature rose above 4°, convection currents might be set up which would subtract heat from the ice. But at a temperature near 4° the convection efficiency is very small and the currents would be weak, especially under the peculiar stratification which obtains below the ice. From another point of view the same conclusion can be drawn. Not more than 100–125 gr. cal. per sq. cm. per day can possibly get through the ice into the water; and only part of this can be used in melting the ice.

E. A. Birge

Madison, Wis.,
June 13, 1910

THE EFFECTS OF DEFORESTATION IN NEW ENGLAND

To the Editor of Science: In their enthusiasm for the conservation of our forests the lecturers and writers on that subject have often been guilty of an over-statement of their case in an endeavor to show that not only are the forests rapidly disappearing but as a result of their removal the land itself is being

speedily and almost totally ruined. The cases cited and the illustrations shown to prove the contention are, for the most part, taken from non-glaciated regions where the soil is, in general, a loose homogeneous residual sand or clay such, for example, as in Kentucky and North Carolina, or homogeneous, incoherent sediments such as occur on our eastern coastal plain; the implication being that this effect is universal. In the regions cited there seems to be no question that the erosive power of the streams has been greatly increased as the vegetal covering has been removed and that large areas, formerly more or less fertile, have become so gullied and denuded of their soil as to render them of little value.

In New England, however, this is true only to a very limited extent. In the Berkshires of western Massachusetts, where the relief is so strong that landslides occasionally occur, one often sees a mountain side so thoroughly denuded of its trees and brush that at a distance it looks like a hay field with the hay in windrows. Under such conditions—a steep slope and lack of vegetation—the conditions are extremely favorable for erosion. However, in spite of these conditions, the mountain streams are beautifully clear except immediately after a heavy rain and are never like the muddy streams of the southern Appalachians where erosion is proceeding rapidly.

The reason for this difference in the amount of erosion under similar conditions of slope and vegetation between glaciated New England and the non-glaciated regions to the south is to be found in the soil and climate. The heterogeneous character of the till of New England is not favorable to erosion because the pebbles and boulders of the till are constantly diverting the water of the run off and are, consequently, lessening its velocity; and also because after gullying has begun the bottom of the gully is protected from further excessive erosion by the pavement of stones derived from the till in which it was cut. Moreover, the moister climate of New England favors a rapid growth of vegetation which soon again binds the soil. In many places in the Berkshires and in Vermont and New Hampshire mountain slopes which rise from 700 to 1,000 feet in one quarter of a mile have been several times stripped of their forest growth with little, though doubtless some, injury to the soil.

HERDMAN F. CLELAND
WILLIAMSTOWN, MASS.,
June 24, 1910

QUOTATIONS

THE FIGHT ON THE COLLEGES

"THERE is no spectacle in American life to-day more pitiful than the contrast between what the college advertises to do and what it performs." "The teaching by our college professors is the poorest in the country." "The average third-year boy in the high school is more able to think, discuss, and express an idea than the average college student two years older." "The young man learns in college that he need not work, he comes to regard his college as a social and sporting club." "Colleges with their narrow and false ideals of culture, . . . their denomination has reached a degree of intolerable impertinence." "The high schools in desperation have been drawing a line of cleavage between those fitting for college and those who are not. This is unnecessary, unfitting and undemocratic."

These are not extracts from an article in a muckraking magazine; they are taken from two addresses delivered yesterday at the meeting of the department of secondary education of the National Education Association in Boston; one by the principal of a New York high school, the other by the state superintendent of public schools in Wisconsin. What was in view in the last of the above quotations may be judged from a resolution almost unanimously adopted at the meeting, declaring in favor of the recognition as electives in college-entrance requirements "of all subjects well taught in the high schools"; some of the subjects especially mentioned in the preamble being manual training, "commercial branches," and agriculture, and the requirement of two languages other than English being expressly objected to. And the situation presented both by the addresses

from which we have quoted, and by the resolutions adopted with practically no dissenting vote, is one with which our college presidents, and all persons interested in college education, will do well to reckon promptly and seriously. . . .

Like all human institutions, the American college is full of imperfections; like them all, it has to undergo change with the passage of time. But it should not bow humbly to every passing wind of popular doctrine. It has a history of which it has ample reason to be proud; it has deserved well of the country, and the work that it has been doing there is still need for it to do. Agricultural schools, industrial schools, technological schools, have grown up alongside of it, and other kinds of schools may be equally necessary, and may meet the needs of a far greater number of individuals. There is no compulsion on any one to go to college, nor is it desirable that every one should have a college education. But out of the thousands who have had this opportunity, a very large proportion have derived from it something that they could not otherwise have got, something that they have prized as an invaluable possession to themselves, and something that has supplied to the country an element without which American life would have been immeasurably poorer. Nor do the confident but reckless assertions of educational muckrakers furnish any reason for believing that the day of its usefulness is past, or for abandoning that spirit of loyalty to the traditions of culture which, until very recently, has been the general possession of our college men.—New York *Evening Post.*

THE ORGANIZATION OF ILL-HEALTH

There are a number of commercial interests in this country that do not want an independent national Department of Health. In recent years we have had many exposures of the patent medicine swindle. We have learned that most of the most popular patent medicines, the so-called tonics, were nothing more than dilute alcohol with certain bitter drugs so as to make them taste mediciny. Physicians have seen alcohol habits formed as a consequence of freely imbibing these alcoholic preparations. Some of them were meant particularly for women's diseases, and the consequence has been a feminine nipping at alcoholic products that has worked serious harm to the women of the country. We have also found that the headache powders so commonly advertised were composed of drugs which, when taken as freely as was advised on the labels of many of these preparations, were seriously dangerous. We have had not a few, but many, deaths as a consequence of them. The soothing syrups for children mostly contained opium and were seriously injuring the growing child at an important period of its development, and adding to the number of nervous wrecks with tendencies to drug addictions in after life that we had in this country.

For a time after these exposures the patent medicine swindlers were very quiet. In many cases their advertisements disappeared from their usual places. Now they are gaining courage again. The American people have proverbially a very short memory for such exposures. The patent medicine people dread very much the organization of a national Department of Health, because this will sadly interfere with their now happy prospect of reviving their business and fattening their purses at the cost of the health of our people. This is one element in the opposition organized for ill-health.

There are others. There are a number of people in this country who would like to be freer to foist drugs, impure foods and questionable products of many kinds on our inhabitants, so as to make money, cost what it might in the health of those who consumed them. The consumer's purse they are interested in, but not his health. The organization of the national Bureau of Health, with its strict enforcement of the Pure Food and Drugs Act, and its sure tendency to further protect by legislation the health of our people, is a dread specter to such exploiters of the public, and, of course, they want to lay it if possible.

The League for Medical Freedom has a rallying cry. It is that the doctors are trying

to create a medical monopoly—a doctor's trust. They insist that the Owen bill is due to the American Medical Association. As a matter of fact the bill emanates from the senator from Oklahoma himself, and the movement for a national Department of Health has been organized, not by the American Medical Association, but by the Committee of One Hundred of the American Association for the Advancement of Science. This organization, as is well known, consists not of physicians, but of the united scientists of the country, and only a very small proportion of physicians are in the membership. The Committee of One Hundred contains the names of many of the representative thinking citizens of this country. They come from all over the country. It is absolutely absurd to talk about such men as organizing a medical trust. Practitioners of all the different cults in medicine are agreed that a national Department of Health would be a good thing, and can not possibly interfere with present state laws as to medical practise. This organization of opposition should of itself be a strong argument for the Owen bill. We have the Organization of Ill-Health for commercial reasons. Let us recognize and appreciate at their true value exactly the elements that are engaged in it.—*The Independent.*

SCIENTIFIC BOOKS

L'Année Psychologique. Troizième Année, 1907; Quatorzième Année, 1908. Publiée par ALFRED BINET. Paris, Masson et Cie.

These two volumes of M. Binet's Année, containing about 500 pages each, are as usual full of contributions of interest and value. Brief notice only can be given here of their rich contents.

The principal papers in the volume for 1907 are as follows:

1. H. Poincaré: The Relativity of Space (17 pp.).—We have no knowledge of an absolute space. Should space and all its contents be increased a millionfold in each dimension or undergo any other deformation according to any laws of any degree of complication whatever, we should know nothing of it provided the deformation applied consistently to everything, including the light rays and our own selves. The three-dimensional space of our perception is derived from the manner in which we perceive and systematize the movements of defence and adaptation that we make. Yet our three-dimensional manner of arranging these has been an efficient adaptation to the world and its properties; and so, though we can conceive of the existence of beings who, differently constituted, would systematize their space in a four-dimensional or other manner, we can not be certain that they could continue to live in our world and protect themselves against its manifold dangers.

2. Foucault: The Progress of Psychophysics (33 pp.).—A critical review of recent work, especially that of Müller, Lipps, Titchener and Aliotta.

3. P. Souriau: The Perception of Mental Facts (16 pp.).—In observing the facial and other expressions of another person, in hearing his words, our awareness is not of these as physical facts, but is of his feelings and ideas. We just as truly perceive these latter as we perceive physical phenomena, and in the same manner. The same thing is true within ourselves. One mental content is perceived always by another, as external to itself, in the same manner as in perceiving external facts. There is no difference in nature, or even in point of view, between introspection and external perception.

4. F. Plateau: Insects and the Color of Flowers (13 pp.).—Careful experiments prove that odor, not color, is the characteristic that attracts insects to flowers.

5. G. Zeliony: The So-called Psychical Secretion of Saliva (12 pp.).—Experiments conducted by M. Pawlow and his pupils add confirmation to the view that "all physiological phenomena may be completely studied as if psychical phenomena had no existence." Direct excitation of the mouth cavity of a dog produces an "unconditional" reflex secretion of the saliva. In case the exciting substance is something the dog eats, the secretion is thick; if it be one that the dog re-

fuses, the secretion is more liquid. Any other excitant, acting on any sense whatever (or any combination of excitants), may provoke a "conditional" reflex secretion of either kind, provided it has previously acted on the animal conjointly with another excitant which has produced an unconditional reflex. The conditional reflexes are very instable and variable. But the exact conditions of their origin, their force and their disappearance can be stated in physiological terms. The so-called psychical excitants are identical with these conditional reflexes.

6. Dr. Ley: Medicine and Pedagogy (8 pp.).—A statement of recent progress in various countries in the application of experimental methods to the solution of pedagogical problems. No details as to experimental methods are given.

7. J. Maxwell: Psychology and Metaphysics (14 pp.).—An account of experiments in apparent telepathy, with discussion of some of their laws of occurrence. Attempts no proof, but rather calls attention to the need of further investigation.

8. J.-J. Van Biervliet: Touch and the Muscular Sense (8 pp.).—Tactile sensibility increases in delicacy not only with natural, but also with acquired motility; as, for instance, that due to piano-playing. It is greater also during actual movement; on the forehead, for instance, if simultaneous contact gives a result of 7, and successive contact 4, movement of the head will reduce it to 2.

9. O. Decroly and J. Degand: Experiments on Visual Verbal Memory and the Memory of Images in Normal and Abnormal Children (11 pp.).—Concrete images are remembered more often and with less error than geometrical forms and single letters; and short phrases, provided they are interesting and concrete, are as easy, if not more easy, to retain in memory as are single words, and much easier than syllables or letters. It is more rational to begin the teaching of reading by the complete representation of an idea than by its elements.

10. B. Bourdon: Cutaneous or Articular Sensibility? (10 pp.).—Reviews the arguments for and against the view that perception of the movement and position of the bodily members is due to articular sensations, and asserts that the following experiments prove it due to cutaneous sensations: (1) A stretching of the skin 0.2 mm. on the back of the fingers can be detected with almost entire sureness; and the most delicately detectable movements of the finger stretch the skin approximately the same amount; (2) anæsthesia of the skin prevents the perception of the most delicate movements.

11. H. Piéron: History of the Belief in the N-rays (27 pp.).—A thorough review of the subject, with a bibliography of 176 titles. "The N-rays (announced by Blondlot of Nancy in 1903) have no existence as an objective phenomenon. This marvelous experience in suggestion has given results of the greatest importance. The N-rays have shown us how, in a great mind, ill served by an excessively nervous temperament, an idea suggested by reflection or previous discoveries has been able, in a field where the subconscious has an immense influence, namely, that of the observation of feeble phosphorescent phenomena in the dark, to excite the perception of variations in brightness systematized by *a priori* conceptions; they have shown us how coincidences and chances that may be traced in detail developed in the same mind a belief in the existence of all sorts of expected properties, and how contagion spread to other minds in which, according to their own prepossessions, new orientations developed new systems under the influence of *a priori* ideas; how, when suggestion did not work, the notion of authority caused others to admit what they could not see; they have shown us also the limits and modalities of the action of suggestion, the limits of the principle of authority which was hardly effective beyond the national frontiers, as well as the factors which opposed these first influences, among which must be recognized national rivalry and personal jealousy; they have revealed the mental character of many French physicists, and shown the necessity among specialists of a psychological and logical education which

would doubtless have averted, in favorable surroundings, so long a propagation of an error so gigantic."

12. Georges Bohn: The Acquisition of Habits in Animals (17 pp.).—A review of experiments by different observers, showing that all animals, even to the lowest forms, are capable of forming associations between sensations and movements. "It is very possible that the mechanism for acquiring habits does not differ greatly in the inferior animals from that of higher animals."

13. Crépieux-Jamin: Expert Examination of Handwriting, and the Lessons of the Dreyfus Affair (43 pp.).—Careful examination of the handwriting of the famous "bordereau," and comparison with the writing of Dreyfus and of Esterhazy, prove conclusively, as is here shown in detail, that Esterhazy was its author. The history of the case is instructive as to the present situation concerning expert testimony in regard to handwriting. There are real experts, reliable though not infallible, and the subject requires much further study and research. But there are also unfortunately many who merely pose as experts, without real knowledge or conscience. It would be desirable to have an official commission appointed to study the subject (as was done, with important chemical conclusions, in 1826), and especially to decide upon practical tests to which would-be experts might be subjected.

14. Étienne Maigre: The Nature and Origin of Instincts according to Weismann (15 pp.).—An exposition of Weismann's proofs that instincts are complex combinations of reflexes.

15. A. Imbert: The Experimental Scientific Study of Professional Work (15 pp.).—In spite of the fact that no reliable estimate in kilogrammeters of the energy expended in the work of laborers is possible, yet definite experimental studies can and should be made as an aid to the establishment of just laws and regulations regarding workmen.

16. R. Masselon: Intellectual Weakness in Dementia Precox, Senile Dementia, and General Paralysis (15 pp.).—Dementia precox is characterized by disappearance of affective phenomena as a primary feature, leading to indifference, apathy, aboulia; by loss of intelligence and by incoherence; but memories are very persistent, disappearing only in the most severe cases.—In senile dementia, memory disturbances are primary; the patient is coherent, and is depressively emotional.—General paralysis shows decrease in memory with increasing incoherence, and relative preservation of the emotional life, involving sudden variations from depression to expansion, with the latter predominant.

17. E. Régis et G. Laurès: Clinical and Psychological Study of Chronic Mental Confusion (17 pp.).—This condition, the characteristic psychosis of organic states of intoxication, is implicitly recognized but has never been described. In it, along with improvement in bodily health, persist the fundamental psychical symptoms of torpor, stupidity, loss of orientation, amnesia. Experimental studies show that the symptoms are due to complete apathy, intellectual, emotional and voluntary, corresponding to the condition of sleep or torpor of the cerebral cells due to the toxic poisons of the acute stage. There are two forms, the simple and the delirious. Dementia may be but a final stage of the series that begins with acute mental confusion and continues in chronic confusion.

18. J. Deniker: The Question of Races in Psychology (16 pp.).—A summary of the author's opinions, as expressed in his book: "Les races et les peuples de la terre," 1900; since which time nothing has been published tending to modify his classification. He recognizes 29 races, divisible into 6 groups on the basis of the character of the hair, or into 17 groups, according to geographical distribution; and he gives briefly the characteristics of these groups.

19. L. Fredericq: The Physico-chemical Conditions of the Action of the Nervous Centers (16 pp.).—Reviews recent progress of knowledge with a bibliography of 48 titles. Considers organic combustion, circulation, materials and products of combustion, elec-

tricity and heat, influence of activity on the development of the neurones.

20. Ch. Chabot: Advocates the Cooperation of the School and the Family (18 pp.).

21. F. Bernheim: Evolution of the Problem of Aphasias (26 pp.).—This problem is still in a process of development. The general acceptance of the classical theory has disappeared, and there are now three principal divergent theories in the field: Déjerine defends the classical localization of the affected centers; Marie locates them very differently; Bernheim of Nancy denies the existence of verbal centers and holds that the lesions affect pathways of connection. To settle the question we need more clinical and pathological anatomical facts, and more reliable psychological analysis.

22. E. Wertheimer: Pain and Pain Nerves (30 pp.).—The sensation of pain is apparently confined to organisms with a highly developed nervous system. Its rôle is purely defensive. In lower organisms there doubtless exists an effective mechanism of defense against destructive external agents involving only appropriate reflexes without pain or consciousness. Abundant evidence shows that the sensation of pain is not due to the action of the nerves of the other special senses; for example, the painful impression produced by an intense light arises, not from any excitation of the fibers sensitive to light, but from excitation of the ciliary nerves due to energetic contraction of the iris. The paper gives at length the evidence for the separateness of the pain-nerves, discusses methods, and reviews the literature dealing with the characteristics of the pain-sensations.

23. A. Van Gehuchten: The Peripheral Nervous Pathways (20 pp.).—Gives the latest results of research regarding the nature of these structures, both centripetal and centrifugal.

24. G. Bonnier: The Double Individuality of Plants (39 pp.).—With the exception of the majority of the mushrooms and some algæ, all plants, including all the higher types, exhibit the double individuality of alternating sexual and asexual generations.

25. G. Cantecour: Sociological Ethics (18 pp.).—A review of modern theories.

26. J. Larguier des Bancels: The Experimental Study of Intelligence and Will (15 pp.).—Contains brief reference to researches by Binet and by Ach, and extended presentation of experiments by Watt on association-reactions of the predetermined type. Dwells less on time results than on introspective data, concerning mainly the stages and mechanism of the process, the existence and kinds of intercalary images between stimulus and response, the existence and nature of the generic image, the fact that the directive thought remains subconscious, etc.

In the fourteenth volume of the Année, that for 1908, M. Binet announces that henceforward it will cover a more definite and limited field than before. It will devote particular attention to practical and social problems. Already in previous numbers there have been considered such subjects in this field as the legal value of testimony, questions in pedagogy, methods of measuring the intelligence of normal children, the classification and instruction of defective children, and the like. These and similar researches will be continued, with the endeavor to render real service to law and to pedagogy, to industrial organization, to pathology, to medico-legal practise, to the individual's choice of occupation and profession. These are truly practical psychological questions, in the full sense of the word.

This number includes the following papers:

1. Binet and Simon: The Development of Intelligence in Children (94 pp.).—The authors have worked out a series of simple tests, applicable to children between the ages of three and thirteen years, for accurately placing them in a "metric scale" of intellectual development. The methods are described in full detail, so that they may be easily applied by others. They believe it to be practical, convenient and rapid. They have used it already sufficiently to assure them of the essential accuracy of its results. It determines whether a child has reached the average normal development in intelligence for his

age or by how many years he differs from it, in advance or behind. It is applicable also to many adults, who are either idiotic, imbecile, or weak-minded, and can make definite distinctions between these three conditions. The paper must be read as a whole by any one interested, for no brief review can give the essential details of the method, the careful analyses of the factors of intelligence, judgment, knowledge and attentiveness involved in the results obtained, and the numerous situations in which it is clearly shown to be of value. Further instances of its application appear later in this volume.

2. L. Houllevigue: Ideas of Physicists in Regard to Matter (15 pp.).—Describes modern views as to the nature of molecules, ether, atoms, electrons and ions; shows that the trinity of matter, ether and electricity is probably reducible to the two last named; and expresses a hope that the universe may possibly some day be explained in terms of ether alone.

3. P. Souriau: The Teaching of Esthetics (15 pp.).—Advocates its introduction into secondary schools, and outlines a course, partly experimental and partly rational.

4. É. Borel: The Calculation of Probability and the Method of Majorities (27 pp.).—A discussion of the value of majorities in establishing the probability of the correctness of the opinions held by them. Among the results of the discussion, these are perhaps the most interesting: The collective sensibility of all observers may greatly exceed the individual sensibility of any one of them, as is shown in an example of estimating weight-differences, where the collective sensibility was twice as fine as the individual. In qualitative experiments, a majority exceeding that which might be due to chance establishes the existence of "something objective" determining its direction; direct observation of the facts must then lead to hypotheses concerning the nature of this "something objective," and these must then be verified by further experiments. The method of majorities is a useful step in arriving at truth.

5. A. Binet: An Inquiry concerning the Evolution of Instruction in Philosophy (80 pp.).—A questionnaire addressed to the 300 teachers of philosophy in France, and answered by 35 per cent. of them, justifies among others the following conclusions: Apart from materialism and pantheism, all types of philosophical thought are still represented. But the teaching of philosophy is undergoing an evolution. There is no longer an official state philosophy. The liberty of the professor is increasing. Dogmatism, formal logic and metaphysics are discredited, partly because the importance of pure reflection has diminished by comparison with the splendid conquests won by experimental methods, partly because of the modern demand for immediate utility. Scientific and practical interests prevail, especially of a sociological nature. Scepticism and pessimism are disappearing because the conception of philosophical teaching has become one of practical activity.

6. A. Imbert advocates the establishment of permanent laboratories for the study of fatigue, nourishment and other questions involved in preventing overwork among professional laborers (17 pp.).—There is need of research to determine the daily task which can be accomplished by workmen of average strength and resistance without detriment to their health.

7. F. Rauh: Ethics and Biology (15 pp.).—For the partisans of a biological ethics, ethical facts are reducible to biological facts. It is true that knowledge of biological laws modifies profoundly our ethical conceptions. But the relation is one of impulsion, of inspiration, not of identity.

8. E. Goblot: Mathematical Demonstration: Criticism of the Theory of M. Poincaré (20 pp.).—In mathematical demonstration, the consequence results from the principles, but is not contained in them as is true in a syllogism. Poincaré solves the difficulty by regarding reasoning by recurrence, or mathematical induction, as the true mathematical method and a form of synthetical judgment *a priori*. Goblot disputes this view, holding that it is the constructive activity of the mind, exfoliating the given facts, that discovers the new results; not inductive, not

synthetic *a priori*, but constructive. This is true of all mathematical demonstrations, including the method of reasoning by recurrence, which is only one form and a relatively rare one. He further distinguishes between the mathematics of functions of three or more variables and the geometry of space. Intuitive geometry is not a mathematical, but a natural science. Finally he holds that M. Poincaré has often wrongly been classed as a pragmatist.

9. A. Binet and Th. Simon: Language and Thought (56 pp.).—By means of their "metric scale of intelligence," described above, the authors are able to determine the degree of intelligence of a mentally deficient person, as equivalent to that of a normal child of such or such an age. The study of imbeciles, idiots, etc., makes it possible to determine exactly what intellectual acquisitions would be possible for a normal child of any particular age, giving results which can not be obtained from the study of the child himself, because his continuing development carries him beyond the level that one desires to study before he has exhausted all its possibilities. Applying this new psychogenic method, the authors believe that they have established by means of precise observations the fact that "there exists thought without images, and without words, and that thought itself consists of an intellectual feeling (un sentiment intellectuel)." This vague feeling becomes precise and detailed, when it produces images, words and acts; but these latter come after the thought.

10. C. Chabot: Hygiene and Pedagogy (15 pp.).—Modern civilization presents this antinomy: there are more and more things which must be learned in order to keep up with the times or gain a livelihood; but the accomplishment of this necessary labor is vain if it ruins the health of the present generation and the future of the race. Scholastic hygiene has a large rôle to play. But it must be within limits. It would be a mistake, for instance, to condemn work in the schools according to the fatigue that it produces. Hygienic regulations must not interfere with the right of the teacher to regulate the work of the scholars who are well, and to determine in what manner a mind or a character is to be formed.

11. G. Cantecor: Pragmatism (25 pp.).—After examining at length its origin, its content and its value, the author finds in pragmatism neither definite problem, nor methodical discussion, nor exact solutions, but only vague affirmations, equivocal statements, hasty improvisations.

12. E. Maigre: A Study of Reflection (10 pp.).—Experiments of Watt, Ach and Messer show that a predetermined relationship influences an association usually in a subconscious manner. Binet arrives at a similar conclusion. Lindley, however, and others hold that a problem is solved by repeated conscious trials, setting out from the given data. These divergent results may be due to the extreme simplicity of the problems given by the first mentioned experimenters. It is clear that the effort of thought becomes more and more voluntary and conscious, in proportion as a problem is complicated, as is illustrated by researches of Bühler and Gard. The author's own observations confirm and complete these results. He believes that it is a feeling (sentiment) on the part of the subject that arrests the associative mechanism when it has led to an association which does not conform to the problem, and that leads to new associations, rather than to a repetition of the old, when one starts again from the first idea. The return itself to the first idea may be a voluntary or an automatic act. Souriau's theory that "by reflection we find more easily ideas apart from the subject that occupies us than on the subject itself," may be occasionally true, but it is no more worthy of being generally followed than would be a theory that it is necessary to solve all problems in sleep because some solutions are found in that way.

13. A. Binet: A Test of Experimental Cheiromancy (15 pp.).—For many years M. Binet has been studying the various external physical signs, such as form of the head, physiognomy, handwriting, that give some indications in regard to intelligence and

character. Having opportunity to make use of the services of a professional cheiromantist, he submitted to her the hands alone (the persons being concealed and no words spoken) of 30 pupils of both sexes, half of them of exceptionally high and half of abnormally low intelligence, demanding only whether she found them intelligent or not. Her diagnosis was correct in 63 per cent. of the cases. Again, he had photographs made of the hands (front and back views) of 20 pupils of both sexes, and submitted them for judgment to 20 persons. The percentage of correct determination of sex was 70, of intelligence 54. But applying the method of majorities (see Borel's paper above), 76.5 per cent. of the judgments were correct; the majority being superior in correctness of judgment not only to the average, but to any one of the individuals composing the average. These results surpass those obtainable by chance; and there is therefore some indication of intelligence furnished by the form of the hand, deserving of more detailed study.

14. A. Binet: A Pedagogical Causerie (27 pp.).—Expresses the author's belief that psychology has more value for pedagogy than was attributed to it in a recent book by James; defends the value of examining the vision of pupils; describes the classes of abnormal pupils recently established in the schools, and the manner of admitting pupils to them only in case a definite but brief examination of their scholastic attainments has shown them to be at least three years behindhand, and another examination according to the "metric scale" (described above) has shown their intelligence to be defective by at least two years; exhibits the value both to normal and abnormal pupils of their association in the same school but in different classes; discusses the question of accurate control of actual progress made, a necessary condition of scientific pedagogy, and asserts that according to one method of control a class of abnormal pupils gained two and a quarter years in one year of the new instruction; develops a plan of mental orthopedic treatment; and gives the results of anthropometric measurements that have been made in comparing normal and abnormal pupils.

15. The volume concludes with a number of bibliographical analyses.

E. B. DELABARRE
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The Conquest of Disease through Animal Experimentation. By J. P. WARBASSE, M.D. Pp. xii + 176. New York, D. Appleton & Co. 1910.

Dr. Warbasse has written a very timely book. The public hears much from the opponents of animal experimentation. Books, special periodicals and public lectures denounce the practise of vivisection and the inoculation of animals with disease germs; even exhibits are gotten up, representing animals undergoing tortures, showing the instruments used to operate on animals without, it is claimed, the use of anæsthetics, making a veritable chamber of horrors for the purpose of prejudicing the public against methods of scientific inquiry which have produced so much of value in controlling human disease. The anti-vivisectionists are busy; they are often influential, and too frequently they are unrestrained by a sufficiently scrupulous regard for truth from misrepresenting, often grossly, the cruelties practised in and the value resulting from experiments on living animals. Repeated attempts are made to get laws passed through state legislatures and the national congress preventing or greatly restricting such experimentation. It can not be doubted that the ardent propaganda of the opponents of vivisection influences public opinion to a very considerable extent. It is easier to appeal to the naïve sympathies of people by recounting tales of cruelty to poor dumb animals than it is to give them an adequate conception of the bearing and probable utility of the scientific experiments on living animals which are being carried on for the conquest of disease. Dr. Warbasse gives, in popular form, a good survey of this general field of investigation. There are chapters on the technique of animal experimentation, the extent to which pain is probably inflicted on animals, the discoveries in physiology due to animal experimentation,

the relation of animal experimentation to medicine, hygiene and surgery, and the conquest of diseases in the animals themselves. Even though one has followed the principal discoveries in medicine as they have been made from time to time, the results when brought together can hardly fail to surprise one whose attention to such subjects has been only casual.

Some opulent philanthropist who wishes to do a service to the cause of medical science would do well to authorize the publishers to send copies of this little book to every state senator and assemblyman, and every member of the national congress, so that our lawmakers may obtain, without more effort than busy men can well afford, a comprehensive idea of methods of research, upon which they are so often importuned to pass restrictive or prohibitory legislation.

Mr. Rockefeller has recently endowed a magnificent institution for medical research. Out of it have already come, by methods which the sentimental zoophilists have so severely condemned, discoveries whose value to the world are many times greater than the cost of the institution. If the well-meaning opponents of animal experimentation had had their way these discoveries would not have been possible. The country would have saved several of its guinea-pigs and homeless dogs, but it would have lost more of its children.

We are never entirely safe from the good intentions of the opponents of vivisection, and it is hoped that Dr. Warbasse's book will be widely circulated and will serve as a corrective of the misinformation which has been so liberally furnished to the public.

S. J. Holmes

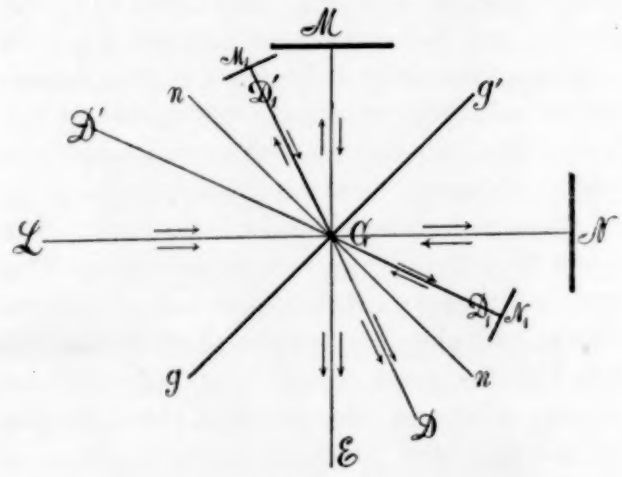
SCIENTIFIC JOURNALS AND ARTICLES

The contents of the current number of the *American Journal of Mathematics* is as follows: "The Osculants of Plane Rational Quartic Curves," by H. I. Thomsen; "On the Primitive Groups of Classes Six and Eight," by W. A. Manning; "Minimalcurven als Orter von Krümmungsmittelpunkten," Von E. Study; "Minimalcurven und Serret'sche Flächen," Von E. Study; "On Steinerians of Quartic Surfaces," by John N. Van der Vries; "On the Determination of the Ternary Modular Groups," by R. L. Börger; "Groups of Transformations of Sylow Subgroups," by G. A. Miller.

SPECIAL ARTICLES

ON THE GENERAL USE OF THE GRATING WITH THE INTERFEROMETER

In a recent number of this journal[1] a method was described of bringing reflected-diffracted and diffracted-reflected rays to interference, producing a series of phenomena which in addition to their great beauty promise to be useful. In fact, the interferometer so constructed needs but ordinary plate glass and replica gratings. It gives fringes rigorously straight, and their distance apart and inclination are thus measurable by ocular micrometry. An adjustment may be made whereby ten small fringes occupy the same space in the field as one large fringe, so that sudden expansions within the limits of the large fringe (as in magneto-striction) are determinable. Lengths and small angles are thus subject to micrometric measurement. Finally the interferences are very easily produced and strong with white light, while the spectrum line used may be kept in the field



[1] From a lecture given to the Eastern Association of Physics Teachers, at Brown University, Providence, on May 21, 1910. See also C. and M. Barus, Science, March 11, 1910, p. 394, and a forthcoming number of the *Philosophical Magazine*.

The same method may be available as an adjunct to either Jamin's or Michelson's interferometers, except that here the transmitted-diffracted and reflected-diffracted rays are brought to interfere. To take the example of the Michelson type stripped of unnecessary details, let gGg' in the figure, be the grating or ruled surface, n its normal, L the source of white light, M and M the mirrors, and E the eye. In the usual way the rays from L interfere at E.

Now replace L by a slit and collimator, E by a telescope focussed for parallel rays. The eye at E now sees a sharp line of light. At D and D', however, there must be two diffraction spectra coinciding in all their parts and hence interfering rhythmically if all adjustments are sufficiently perfected. The other two diffractions within MGg' and EGg are often lost at an incidence of 45°.

The attempt to produce these interferences D, D', with replica gratings is liable to result in failure: for while the transmitted system NGD shows brilliant spectra, the reflected system MGE is dull and hazy. Both spectra are clearly in evidence and may be brought to overlap. The film, however, does not reflect in a degree adequate to the transmission. Attempts are in progress to realize the condition of equality with a grating actually ruled on glass or possibly with a modified film.

What is strikingly feasible, however, with ordinary plate glass and a non-silvered grating, is the production of interferences between pairs of diffracted spectra, D_1' and D_1, for instance, if returned by equidistant mirrors M_1 and N_1 to a telescope in the line D. Both of these spectra are very brilliant and not very unequally so, and the coincidence of spectrum lines brings out the phenomenon. This is of the *ring type*, and not of the line type referred to above; but it also occupies the whole field of the spectrum from red to violet. In my first adjustment using sunlight, I obtained splendid large confocal ellipses, with the dark centers in the yellow, the sodium line simultaneously in focus serving as a major axis. It is more usual, however, to obtain oblique lines across the spectrum which are strongest in certain color fields. In a city laboratory these are perpetually in motion, the rings particularly alternating between dark and bright centers. Naturally a fine slit is of advantage. The theory of these ellipses will be given elsewhere.

CARL BARUS

NOTES ON AN EXPERIMENT CONCERNING THE NATURE OF UNIT CHARACTERS

SOME time ago the writer planned[1] a series of experiments designed to throw some light on the nature of unit characters. Only one part, of which the following is a brief extract, has been completed. If an apology is necessary for daring to present negative results, I might say that even if proof of a negative is logically impossible, such evidence does give an idea of the relative frequency of the occurrence of the event in question. It is sometimes forgotten that a small probable error is as desirable in this case as when the results are positive. In addition to this fact, however, it is a pleasure to call attention to a line of experimentation which, though familiar to all biologists, has not had the serious consideration that it deserves. I mean the work of MacDougal in trying to produce mutations or transmissible variations by artificial means. Even if one does not accept as fact that the definite and transmissible changes which have occurred in Dr. MacDougal's injection experiments were caused directly by the introduction of semi-toxic solutions into the mother plant's ovary, he should admit that the method proposed is well worth his earnest attention. It is capable of several modifications and extensions—two of which I shall describe—which if given sufficient trial might yield results with important bearings somewhat apart from the original scope of MacDougal's investigations. Even if many experiments on limited populations should give no positive results, it should be remembered that progressive variation occurs but rarely in nature, possibly but one variant in millions of individuals. One ought

[1] At the Connecticut Agricultural Experiment Station, under the federal appropriation known as the Adams fund.

then to expect to increase this proportion only if he can multiply artificially the effectiveness of nature's causes; and it seems hardly reasonable to be disappointed if positive results are not obtained from experiments with only 1,200 or 1,500 plants.

One method which in spirit is an extension of the injection work was suggested by Osborne's investigations on plant proteids. Work on the ultimate composition of pure proteids has only been touched, but the fundamental researches that Osborne and his associates have carried on for the past twenty years have shown, even with the crude methods of our general analytic chemistry, that the proteids of different species of plants are very different in composition, the differences becoming more definite as the plants are further apart in the natural system. These facts immediately suggest the possibility that if the plant of one species could in its first life stages utilize the stored proteids of the endosperm or cotyledons of a very different type, changes would probably be induced in it, some of which might be heritable. This treatment is quite different from that where plants are fed different quantities of inorganic compounds in the form of the so-called essential elements of soil fertility. Food compounds and enzymes or producers of enzymes of a different kind from those ordinarily produced and used by the plant, are ready for its use in the very early formative period of ontogeny. If any changes can be expected to come about indirectly through changes in nutrition, they should be expected to occur under such treatment. It is possibly not a phenomenon that could occur naturally, yet since variations are caused by some cell activity different from the normal, they might very well be caused by the production of a different proteid or part of a proteid molecule, different from that normally produced but similar to what is produced by other plants. Then again similar conditions are probably produced when severe changes in temperature occur during the maturation of the seed. In fact, abnormal temperature conditions seem to have similar effects on somatic cells, for Webber[2] once stated that after the last great Florida "freeze" bud variations were very numerous in the trees that were severely injured. It is likely, too, that specialized parasites may have had changes in their own structure brought about in this way. Of course one must recognize the fact that a great many data are at hand on the effect of the stock upon an engrafted scion, all of which are negative or questionable. In this case, however, conditions are not similar. The bud or branch used as a scion is not at all in the same ontological stage as are the young seedlings in the experiments proposed. I have mentioned this matter at greater length than I had intended, but I have had the chance to try only some preliminary experiments with grafted cotyledons, and hope the plans might find favor with others who could work on a larger scale.

The second experiment which included observations on 1,200 plants is somewhat different. There seemed a possibility at least that if certain characters are due to the presence of an enzyme, this enzyme might actually be added to a plant which had not inherited either the enzyme itself or the ability to produce it, if the proper time of addition and the proper method could be found. This is pure speculation with no analogies, although it is likely that the mosaic disease of tobacco is an enzyme effect that can be communicated by infection. This disease, however, is not inherited through the seed, and may prove to be bacterial.

The subjects selected for experiment were two varieties of tomatoes, Sutton's Best of All, a variety with red flesh, and Golden Queen, a variety with yellow flesh. Hurst had already shown that all tomatoes possessed yellow flesh and that presence and absence of red flesh acts as a simple Mendelian pair. In order to be certain that we are dealing with the same characters, however, the two varieties were crossed and Hurst's work corroborated. Golden Queen, the yellow variety, was grown to flowering in sterilized soil. Flowers were castrated and bagged. When the stigmas were receptive they were pollinated with pollen from the same plants, which had been kept pure by bagging. At intervals of one hour after pol-

[2] In a personal communication.

linating—up to fifteen hours—different ovaries were injected with one of three solutions. Solution one was obtained by macerating one part by volume of seeds of the red variety in four parts water. Solution two was made by macerating the flesh of ripening fruit of the red variety and adding 50 per cent. water. Solution three was made by macerating pollen from the red variety in about nine times its bulk of water and filtering.

Seed was obtained from most of the injected ovaries, but the resulting fruits gave absolutely no trace of red coloration. The seeds from the treated ovaries were again planted in sterilized soil and gave nothing but normal Golden Queen fruit.

I have no doubt but that an experiment of this kind seems utter foolishness; most experiments yielding negative results do. Biologists, however, have generally accepted the suggestion of physiological chemists that life processes are in the nature of enzyme processes. Perhaps this is because one is behind a safe barrier of ignorance when he speaks of enzymes. But in the case of plant sap colors and animal pigments there certainly is reason to believe that their production is accelerated by enzyme action. If this is true, color-producing enzymes should show action comparable to that of other enzymes. As to the general properties of enzymes, however, little is known. Perhaps they can be stated in the following definition. Enzymes are catalysts that have thus far been produced only by living organisms. Two of their properties may be mentioned that especially interest us here: one, which they hold in common with inorganic catalysts, that of changing the rapidity of progress of a reaction already initiated, but not appearing in the final product; the other, that of possessing colloidal nature and a large molecule. The size of the molecules of all known enzymes and their colloidal nature makes it improbable that any extract containing a color-producing enzyme should reach the ovules of a treated ovary; it is not at all impossible, however, that such an extract might come in contact with the male nucleus as it is journeying from the stigma to the micropyle. Further, if one may argue from the work that has been done on artificial digestion, enzymes should be able to do their work after extraction. This work, then, simply shows failure under the conditions described. It may be that failure should always be expected, yet with proper analysis of some of the attendant physical and chemical processes, some valuable results might be obtained.

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TROUGH FAULTING IN THE SOUTHERN ADIRONDACKS[1]

FOR some years certain prominent physiographic features in the eastern Adirondacks have been regarded as due chiefly to normal faulting. Thus, many of the conspicuous mountain ridges, lakes, and drainage lines strike north-northeast and south-southwest and are undoubtedly largely dependent upon faults striking in the same direction. Within the pre-Cambrian crystalline rock area, it is almost impossible to work out these faults in detail, but, along the border of the Adirondacks, where the Paleozoic sediments overlap upon the crystallines, the faults are often well shown, especially where they affect both the pre-Cambrian and Paleozoic masses. Attention is here directed to the well-known series of Mohawk valley faults which nearly all downthrow on the east side, often have branches, and sometimes extend northward into the pre-Cambrian area. The faults and minor cross faults of Clinton county, near Lake Champlain, are also well known. Thus far no rather extensive trough faulting has been definitely described in the Adirondack region, the comparatively small trough block between the Little Falls and Dolgeville faults being perhaps the best illustration. It is the purpose of this article to call attention to a case of trough faulting on a large scale and also to point out the probable importance of this type of faulting in the Adirondacks.

Within the Broadalbin quadrangle (Fulton-Saratoga counties), which the writer is at present engaged in studying, detailed work

[1] Published by permission of the New York state geologist.

has shown the area to be unusual for its numerous faults, some of very considerable displacement. Two of the largest of these are the Noses and the Hoffman's ferry faults, which have already been described, the former cutting across the northwestern and the latter the southeastern portion of the Broadalbin quadrangle. The maximum throw of the Noses fault is about 1,500 feet and that of the Hoffman's ferry fault about 2,000 feet, with downthrow in each case on the east side. Recent work shows the Hoffman's ferry fault to extend much farther northward than formerly supposed, or from north of Galway to beyond Corinth and with increasing throw northward across the northwestern portion of the Saratoga quadrangle and producing the great scarp of pre-Cambrian rock. The Noses fault follows the base of the high (1,000 feet) escarpment of pre-Cambrian rock which extends from west of Gloversville to northwest of Northville.

Another dislocation of unusual interest is here briefly described for the first time and should be called the Batchellerville fault. From a point about two miles southeast of Northampton it strikes north-northeast for at least 8 miles along the Sacandaga river and through the village of Batchellerville. The maximum throw is nearly 1,500 feet and the high (1,000 feet) escarpment of pre-Cambrian rock is a very pronounced topographic feature. The most significant thing about this new fault is the fact that it downthrows on the west and is thus the only great Mohawk valley fault showing this characteristic. The Batchellerville and Noses faults run approximately parallel and are about six or seven miles apart, the great escarpment of pre-Cambrian rock of the one fault facing the equally great escarpment of the other. In other words we have here a fine illustration of trough faulting, the whole country between the Batchellerville and Noses faults being a great depressed fault block much of which now lies fully 1,000 feet below the level of the scarps on either side. A glance at the Broadalbin quadrangle will show the extent of this fault block, whose northern extremity is not yet known but which occupies at least 75 square miles or all of the region between the following points: 3 miles north of Batchellerville; 2½ miles northwest of Northville; 2 miles west of Mayfield, and 2 miles southeast of Northampton. On the state geological map the deep indentation caused by the northward extension of the Paleozoic rocks to Northville roughly corresponds to this depressed block, although recent mapping by the writer shows that the Paleozoic should extend at least 6 or 8 miles farther northward along the Sacandaga River. The surface rock over this depressed area is chiefly Little Falls dolomite, with some pre-Cambrian rock towards the north and some Trenton limestone and Utica shale towards the south. The trough block is not perfectly simple, because, on the west side especially, a number of minor fractures have considerably modified it and some of these minor faults are so arranged, as at Northville, that small trough fault blocks are included between them.

Eastward from this trough block and lying between the Batchellerville and Hoffman's ferry faults is a great upraised block of pre-Cambrian rock covering at least 100 square miles and including all of the high country in the northeastern portion of the Broadalbin and the northwestern portion of the Saratoga quadrangles. This uplifted block comprises the great tongue of pre-Cambrian rock shown on the state geologic map between Saratoga Springs and Northville.

The profound influence of trough faulting upon the topography in this region strongly suggests the occurrence of similar phenomena well within the Adirondacks. As Professor Cushing stated several years ago, the topography of the eastern Adirondacks often suggests faulting of this sort but positive proof has heretofore failed. The finding of such a large and clear-cut trough fault at the southern margin of the pre-Cambrian rocks greatly strengthens the belief that faulting of this sort has had an important influence upon the topography of the eastern Adirondacks.

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